SUB C1 49. (New) The apparatus according to Claim 25 wherein the program instructions to analyze the energies of the digital signal analyze the energies at about the highest frequency of the sinusoids.

a7 cont

50. (New) The computer-readable medium of Claim 34 wherein the sampling frequency is about 2 kHz.

51, (New) The computer-readable medium of Claim 34 wherein splitting the electrical signal is performed at about the highest frequency of the sinusoids.

SUB C1 52. (New) The computer-readable medium of Claim 34 wherein analyzing the energies is performed at about the frequency of the sinusoids.

REMARKS

Claims 1-40 are pending in the application. Claims 1-40 were rejected. Claims 1, 17, 25, 32, 34, and 40 are being amended. Claims 41-52 are being added. No new matter is being introduced.

Before responding to the specific rejections, Applicants believe that a brief discussion of the Applicants' claimed invention and the cited references may be useful.

A system employing the principles of the Applicants' invention may be deployed in a Public Switched Telephone Network (PSTN) to detect dialed digits, for example, at the beginning of a phone connection. In the PSTN, the dialed digits may be represented as Dual-Tone, Multi-Frequency (DTMF) sinusoids in a range between 0 Hz and about 2 kHz, as shown in Table 1 on page 2 of the specification as originally filed. Other forms of dialed digits, such as multi-frequency, one row (MF-R1) sinusoids and multi-frequency, two row (MF-R2) sinusoids are also present in PSTN's in the same 0-2 kHz frequency range, as shown in Tables 2 and 3 on page 2 of the specification as originally filed.

4 kHz 8 samples/sec to avoid aliasing

An analog signal in a PSTN has a bandwidth of ~~8~~ kHz for carrying voice data. This 8 kHz analog signal is typically digitized at a sampling frequency of 8 kHz for processing by

detectors implemented in digital processors. A current interest is in maximizing the density of DTMF/MF-R1/MF-R2 detectors in a processor while maintaining a high degree of reliability.

Applicants address the issue of increasing density of detectors by splitting the sampled input signal into subbands. As discussed on page 6, lines 23-25 of the specification as originally filed, "by splitting an input signal into subbands, filters employed by the processor operate at slower sampling rates and are, therefore, less complex." This suggests that the subbands are at least one rate reduction below the sampled input signal. This rate reduction allows the detector channels to operate at slower sampling rates, saving instruction cycles for other operations, such as supporting additional detector channels.

Referring to Fig. 3 of the specification as originally filed, a 4 kHz digital signal (i.e., 8 kHz sampled analog signal once decimated by a factor of 2) is presented to a DTMF detector 240a operating in a processor. DTMF (and MF-R1/R2) signals include sinusoids located between 0 Hz and about 2 kHz. Applicants identified that it is possible to reduce the sampling frequency of the once-decimated digital signal from 4 kHz to 2 kHz and still detect the DTMF sinusoids. This is recited in now amended Claim 1 ("subbands being at a sample frequency of about a highest frequency of the sinusoids").

As true in any sampling frequency system, aliasing may occur as a result of sampling, decimation, or other discrete-time operation. Applicants teach use of an efficient band-split filter 300, having low- and high-pass filter characteristics described by the frequency responses of Fig. 6, that performs the 4 kHz to 2 kHz sample rate reduction and prevents aliasing of the 1-2 kHz DTMF signals from "appearing" as 0-1 kHz signals and the 0-1 kHz DTMF signals from "appearing" as 1-2 kHz DTMF signals.

In contrast, Cox et al. teach, in reference to Fig. 2 of Cox et al., a detector that includes a decimator 12 that decimates the sampled 8 kHz analog signal to 4 kHz. The down sampled data on line 13 is directed to a high-band isolation filter 14H and a low-band isolation filter 14L. As discussed in column 5, lines 40-41, the high-pass filter is designed for a sampling frequency of 4 kHz, and, as discussed in column 5, lines 46-47, the low-band filter is also designed for a sampling frequency of 4 kHz. The other components in the detector are also designed for a sampling frequency of 4 kHz.

If the detector taught by Cox et al. were presented with a 4 kHz sampled signal at the input line 10, an aliased signal would result due to a lack of filtering prior to or as part of the decimator 12. To prevent aliasing, Cox et al. would need more than a single low-pass filter prior to or as part of the decimator 12 because of the two parallel paths that follow (i.e., through the low- and high-pass filters). Cox et al. neither teach nor suggest (i) a second decimation or (ii) a two filter arrangement prior to or as part of a second decimation to reduce the sample frequency from the 8 kHz sampled analog signal to a 2 kHz sampled signal for detecting DTMF/MF-R1/R2 sinusoids.

Rejections Under 35 U.S.C. § 102(b)

Claims 1-2, 6-7, 11-15, 17-18, 32, 34-35, and 37-39 were rejected under 35 U.S.C. § 102(b) as being anticipated by Cox et al. (U.S. Patent 5,353,346). As discussed above, Cox et al. teach a DTMF detector having sampling rate decimation. The sampling rate decimation reduces the sampled analog signal from an 8 kHz sampled signal to a 4 kHz sampled signal. The detector operates on this 4 kHz sampled signal to detect the DTMF sinusoids, which span between 0 Hz and about 2 kHz. In other words, the Cox et al. DTMF detector operates at a sampling frequency of twice the rate of the DTMF sinusoids. Thus, Cox et al. do not teach every claim limitation of now amended Claim 1 ("subbands being at a sampling frequency of about a highest frequency of the sinusoids").

Accordingly, the Applicants respectfully submit that the rejection under 35 U.S.C. § 102(b) should be withdrawn.

Because Claims 2, 6-7, and 11-15 depend from Claim 1, these claims should be allowed for at least the same reasons.

Independent Claim 17 as now amended includes similar claim limitations ("subbands being at a sampling frequency of about a highest frequency of the sinusoids") as now amended Claim 1. Therefore, Applicants respectfully submit that amended Claim 17 should be allowed under 35 U.S.C. § 102(b) for similar reasons as now amended Claim 1.

Because Claim 18 depends from Claim 17, this claim should be allowed for at least the same reasons.

Claim 32 has now been amended to include similar claim limitations ("subbands being at a sampling frequency of about a highest frequency of the sinusoids") as amended Claim 1. Therefore, Applicants respectfully submit that amended Claim 32 should be allowed under 35 U.S.C. § 102(b) for similar reasons as now amended Claim 1.

Independent Claim 34 has been amended to include similar claim limitations ("subbands being at a sampling frequency of about a highest frequency of the sinusoids") as now amended Claim 1. Accordingly, Applicants respectfully submit that Claim 34 should be allowed under 35 U.S.C. § 102(b) for similar reasons.

Because Claims 35 and 37-39 depend from Claim 34, these claims should be allowed for at least the same reasons.

Rejections Under 35 U.S.C. § 103

Claims 3-5 and 19-22, 27 and 36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Cox et al. in view of Applicants' admitted prior art.

Claims 3-5 are dependent from Claim 1; Claims 19-22 are dependent from Claim 17; and Claim 36 depends from Claim 34. Thus, the foregoing arguments apply.

Claim 27 depends from Claim 25, and Claim 25 has been amended to include similar claim limitations ("subbands being at a sampling frequency of about a highest frequency of the sinusoids") as now amended Claim 1. Claims 26-31 depend from Claim 25.

The Applicants' admitted prior art does not teach, suggest, or provide motivation for the claim amendments ("subband being at a sampling frequency of about a highest frequency of the sinusoids"). Accordingly, in combination with Cox et al., which teaches detection of the DTMF sinusoids at a sample rate of 4 kHz, Applicants believe that the claims as now amended are non-obvious in view of same. Accordingly, Applicants respectfully submit that the rejections under 35 U.S.C. § 103(a) in view of Cox et al. and admitted prior art should be withdrawn.

Claims 8, 16, 17, 23, 25-31, 33, and 40 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Cox in view of well known prior art (MPEP 2144.03). For reasons discussed above, Applicants respectfully submit that Cox et al. in view of well known prior art does not teach, suggest, provide motivation for every claim limitation of the independent claims as now amended ("subbands being at a sampling frequency of about a highest frequency of the

sinusoids"). Accordingly, Applicants respectfully submit that this rejection under 35 U.S.C. § 103(a) should be withdrawn.

Claims 9-10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Cox et al. in view of well known prior art, further in view of Stroobach (U.S. Patent 5,119,322). Stroobach is directed to MF-R1 and MR-R2 tones. However, Stroobach does not teach, suggest or provide motivation for Applicants claims as now amended. Accordingly, Applicants respectfully submit that the rejections under 35 U.S.C. § 103(a) should be withdrawn.

Claims 1-40 were provisionally rejected under 35 U.S.C. § 101 as claiming the same invention as that of Claims 1-4 and 10-11 of co-pending application No. 09/812,057.

In co-pending application No. 09/812,057, the preamble of Claim 1 as originally filed recites "a method for classifying a communication signal . . .". Referring to page 2, line 20 of the specification of the cited co-pending applications, signal classification is referred to as a high-level function, in which a "signal classifier distinguishes communication protocols from one another." Applicants submit that the classifying signals is patentably distinct from "determining, in an electrical signal, a presence of sinusoids used to encode dialed digits," as found in the preamble of Claim 1 in the application at hand.

Accordingly, Applicants respectfully submit that the double patenting rejection under 35 U.S.C. § 101 is improper and should be withdrawn.

CONCLUSION

In view of the above amendments and remarks, it is believed that all now pending claims (Claims 1-52) are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned at (978) 341-0036.

Respectfully submitted,

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MARKED UP VERSION OF AMENDMENTS

Claim Amendments Under 37 C.F.R. § 1.121(c)(1)(ii)

1. (Amended) A method for determining, in an electrical signal, a presence of sinusoids used to encode dialed digits, the method comprising:

splitting the electrical signal into subbands being at a sampling frequency of about a highest frequency of the sinusoids; and

analyzing energies within subbands to determine the presence of the sinusoids [corresponding to frequencies of the dialed digits].

17. (Amended) An apparatus, comprising:

a splitter to separate an electrical signal, including sinusoids corresponding to frequencies of dialed digits, into subbands being at a sampling frequency of about a highest frequency of the sinusoids; and

an analyzer to measure energies within the subbands to determine a presence of the sinusoids [corresponding to frequencies of dialed digits].

25. (Amended) An apparatus, comprising:

an analog-to-digital converter sampling a received analog signal, including sinusoids corresponding to frequencies of dialed digits, and outputting a corresponding digital signal; and

a digital processor coupled to an output of the analog-to-digital converter to receive the digital signal, the digital signal processor executing program instructions to:

split the digital signal into subbands being at a sampling frequency of about a highest frequency of the sinusoids; and

analyze energies within the subbands to determine a presence of the sinusoids [corresponding to frequencies of dialed digits].

32. (Amended) An apparatus, comprising:

means for splitting an electrical signal, including sinusoids corresponding to frequencies of dialed digits, into subbands being at a sampling frequency of about a highest frequency of the sinusoids; and

means for analyzing energies within the subbands to determine a presence of the sinusoids [corresponding to frequencies of dialed digits].

34. (Amended) A computer-readable medium having stored thereon sequences of instructions, the sequences of instructions including instructions, when executed by a processor, causes the processor to perform:

splitting an electrical signal, including sinusoids corresponding to frequencies of dialed digits, into subbands being at a sampling frequency of about a highest frequency of the sinusoids; and

analyzing energies within the subbands to determine a presence of the sinusoids [corresponding to frequencies of dialed digits].

40. (Amended) A voice-over-IP device, comprising:

a receiver receiving electrical signals composed of voice signals and dialed digit sinusoids corresponding to dialed digits;

a detector coupled to the receiver [monitoring] to monitor the electrical signals and [detecting] to detect the dialed digit sinusoids [corresponding to dialed digits], said detector including:

a splitter to split [splitting] the electrical signal into subbands[,] being at a sampling frequency of about a highest frequency of the sinusoids; [and]

an analyzer to analyze [analyzing] energies within subbands to determine a presence of the sinusoids [corresponding to frequencies of the dialed digits]; and

a generator to generate [generating] packets of data comprising (*i*) voice signal data and (*ii*) information corresponding to the dialed digits.